# Device for Producing Expanded Flat Material

The invention relates to a device for producing expanded flat material, comprising a cutting and expanding device and a coiling device, the starting material for which is a foil web that is guided between cutting rollers supported one above the other, formed of individual upper smooth cutting knives and lower cutting knives forming the cut length through recesses alternately in the cutting area, the expanding device having pairs of toothed belts or the like conveyor means guided over partially driven deflection rollers, which conveyor means hold the foil web at the edges and make it advance.

A device is known from US 4,102,024 that relates to the production of expanded material. A large number of punch knives are hereby pressed onto the foil web and they are simultaneously guided gradually outwards so that an expanded strip is produced. A guide wheel is used to center the expanded strip. A drawback is that a lateral hold is not given and thus flat layers cannot be obtained due to the length differences with the edges.

Furthermore, US 4,486,927 discloses a device for producing expanded material in which cutting rollers are used to achieve the perforation. An expanding device presses the foil web gradually downwards with a number of expanding wheels so that a V-shaped expanded strip is formed. A flat material strip cannot be produced here either.

According to EP 0 669 176 a method and a device for producing dimensionally stable spherical bodies is also proposed in which an expanding device is likewise provided to form a foil web into an expanded strip. A corresponding upper and lower toothed belt pair is hereby used, which holds the foil web at the edges and transports it, a bow directed upwards being provided between the belt pairs, which bow renders possible the expansion of the foil web. Since such an expansion bow has the disadvantage of producing dust particles through friction, there has now been a change to using a moveable roller in place of the expansion bow.

In order to obtain a uniform expansion, the roller was embodied to be split and axially adjustable. One drawback was discovered to be that although the friction particles were reduced, unevennesses occurred in the center of the expanded strip, i.e., it was difficult to achieve a uniform embodiment of the expanded strip over the entire width.

Furthermore, similar devices are shown by patents US 4,621,397 A, US 4,305,187 A and US 5,088,170 A, but they do not relate to the subject matter of this application.

On the basis of this prior art, the object of the invention was to create a device for producing flat expanded material that contains an expanding device that gives the expanded strip a uniform structure over the entire width. According to the invention, the object is attained in that the expanding device on both sides of the foil web has respectively one toothed belt pair that guides the foil web vertically upwards with one lateral edge, starting from the horizontal plane, via hinged, optionally rigid, sliding blocks arranged in the interior area of the toothed belts, while the other lateral edge of the foil web is guided vertically downwards in the same manner, i.e., forming a scissor movement, and an expansion of the foil web is formed across the resulting diagonal.

It is thus achieved that a flat expanded strip can be produced that is free from internal tensions.

It is advantageous if the sliding blocks have hinges and these are adjustable in height. Different expansion widths can thus be adjusted.

It is also advantageous if the upper sliding block is embodied to be vertically displaceable to the inside of the toothed belt. It is hereby possible to take into consideration the material strength of the expanded strip.

It is also advantageous if the sliding surfaces of the upper sliding block and of the lower sliding block are embodied with equidistant spacing as flat planes, or optionally with surfaces provided with a radius, which form a gradual transition

into the expanded position t produce the foil web. This is important so that the toothed belts hold the edge of the foil web over the entire length.

The invention will be explained in more detail on the basis of an exemplary embodiment. They show:

Fig. 1 Device in side view with expanding device

Fig. 2 Front view of the expanding device (section A – A)

Fig. 3 Embodiment variant of the expanding device

Fig. 4 Embodiment of the toothed belts (detail B)

Fig. 1 shows in diagrammatic form a device for producing expanded strips in which the expanding device 10 according to the invention is arranged. From a supply drum 2, on which a foil strip 1 is wound as starting material, the latter is guided to the cutting device 3. This cutting device 3 is essentially composed of an upper cutting roller 4 and a lower cutting roller 5 supported one above the other. The upper cutting roller 4 is embodied as a smooth roller with cutting means, while the lower roller 5 features alternately recesses in the cutting area forming the cut length. After the foil web 1 has been given slots at regular intervals while running through, it is guided to a tensioning device 6. This has a deflection roller 7 arranged at the start, the foil web 1 being brought downwards to a tensioning roller 6 and subsequently upwards by deflection roller 8 into the horizontal position again, in order then to be guided into the expanding device 10.

The expanding device 10 contains on each side essentially one toothed belt pair 18, 19 that is guided over a number of deflection rollers 11 through 17 and is positioned at the edges of the foil web 1. Thus the upper toothed belt 18 is guided around the deflection rollers 11, 13 and 15, the teeth of the toothed belt side 20 pointing outwards. In contrast, the toothed belt side 21 is smooth and rests on the inside. Likewise, the lower toothed belt 19 is guided over the deflection roller 12, 14 and 16, 17. Here too the toothed belt 19 is toothed towards the outside, while the inside in turn is embodied to be smooth. The

toothed belt pairs 18, 19 are engaged between the deflection rollers 11, 12 and 13, 14 and hold the foil web 1 firmly at the edges. Toothed chains or the like conveyor means can also be used in place of the toothed belts. In the center of the expanding device 10 is an upper sliding block 22 and a lower sliding block 23. The upper sliding block 22 has a guide that with a flat plane, optionally a radius R, guides the edge of the foil web 1 from the deflection roller 11 to the deflection roller 13.

The guide is also present at equidistant spacing in the lower sliding block 23, such that the two toothed belts 18, 19 are engaged and the edge of the foil web 1 lies between them. One of the deflection rollers, e.g., 11, is embodied as a drive roller.

Advantageously the lower deflection roller 12 is also embodied as a drive roller in order to ensure a uniform pull of the belt pairs 18, 19. The upper sliding block 22 has another adjusting device 24 so as to be able to align it vertically to the inside of the toothed belt 18 and to vary the contact pressure.

The lower toothed belt 19 now runs over the deflection roller 12 mentioned above, which can be embodied as a drive roller and is guided over the deflection rollers 14, 16, 17. However, it is also possible to transmit the drive via a pinion 33 to the toothed belt side 20, because thus only one drive train is needed. In the area of the upper sliding block 22, the lower sliding block 23 is now rigidly attached to the machine frame.

On the opposite side of the expanding device 10–shown by a broken line in the drawing for reasons of clarity—in the same way a toothed belt pair 18,19 is arranged that now engages at the edge of the other side of the foil web 1. However, the difference is that the edge of the foil web 1 is guided downwards. Although the arrangement of the deflection rollers is the same, it is turned upside down. The same applies to the sliding blocks 22, 23. At the entrance to the expanding device 10, the foil web 1 is flat, is gripped by toothed belts 18, 19 and guided upwards by one side through the sliding blocks 22, 23 and the arrangement of the deflection rollers 13, 14. On the opposite side the toothed

belt pair 18, 19 is guided downwards by the position of the deflection rollers 31, 32. Through the engagement of the toothed belt pairs 18, 19 a tooth-like profile is produced on the edges, which during the lateral stretching of the foil strip 1 equalizes the length change during the expansion and thus produces a flat expanded strip. The foil web 1a guided out of the expanding device 10 now comes onto a deflection 25 that is composed of a smooth roller pair 26, 27 supported one above the other. This is important in order that the residual tensions are eliminated. Subsequently, the expanded foil web 1a comes onto a take-up roller 28.

The front view of the expanding device 10 is shown in Fig. 2 according to section A – A of Fig. 1. In the center is the foil web 1 as it is inserted into the expanding device 10. Through the arrangement of the toothed belt pairs 18, 19 and the thus necessary deflection rollers and the sliding blocks 22, 23, the edge of the foil web 1 is pressed upwards and in the same way brought downwards on the other side of the edge. The slots made in the foil web 1 are widened through this change in width. Advantageously, this expansion is 5-fold, preferably 3-fold the original width. This depends primarily on the material consistency, but also on the selected cut length of the foil web 1. The deflection rollers 13, 14, 17 and the sliding blocks 22, 23 are hereby arranged for the edge of the foil web 1 guided upwards, while the deflection rollers 31, 32 are used for the edge guided downwards.

Fig. 3 shows a variant of the expanding device 10, the sliding blocks 30 of which are embodied to be moveable by a hinge 29 according to arrows. They can adapt well to the guiding of the toothed belt pairs 18, 19. Otherwise, the same reference numbers apply for the deflection rollers as already mentioned in Fig. 1. The deflection rollers 11, 13, 15 are responsible for the upper toothed belt 18, while the deflection rollers for the lower toothed belt 19 have the reference numbers 12, 14, 16 and 17 seen in the direction of movement. The same applies to the other side that then runs over the deflection rollers 31, 32 for the edge guided downwards. Here too the other side of the expanding device is shown by a broken line.

Fig. 4 shows the embodiment and position of the toothed belts 18, 19, which at this point are arranged labeled B in Fig. 1. The teeth are in mutual engagement and between them lies the foil web 1, which now takes on the toothed shape. The outer sides of the toothed belts 18, 19 are provided with smooth toothed belt side 21.

The essential advantage of this expanding device 10 lies in that this is simple in construction, can be variably adjusted and moreover produces a uniform structure over the entire width of the expanded foil web 1a. However, this is the prerequisite for the versatile use of such expanded strips.